

In Memoriam: Kirk R. Smith

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The field of environmental health has lost a visionary leader, charismatic advocate, and tireless humanitarian. Kirk R. Smith passed away on 15 June 2020 at the age of 73 following a stroke. Kirk was a professor of global environmental health at the University of California (UC) Berkeley School of Public Health and director of the Collaborative Clean Air Policy Center in Delhi, India. He also held honorary professorships at the Sri Ramchandra Institute of Higher Education and Research in Chennai, India; Tsinghua University in Beijing, China; and the Mongolian National University of Medical Sciences in Ulaanbaatar, Mongolia.

He was an author on more than 400 publications, including his 1987 book, *Biofuels, Air Pollution, and Health*. He introduced and elaborated on various frameworks and concepts—including intake fraction, climate and health cobenefits, and the environmental risk transition—that are fundamental parts of environmental health today. His groundbreaking work on the first global comparative risk assessment firmly established household energy as a leading risk factor for global health and later spurred efforts to solidify the link between household and ambient air pollution. For these achievements and many others, he received numerous awards.

Kirk began his career evaluating the health impacts of nuclear energy in the 1970s. He founded the Energy Program at the East–West Center in Honolulu, Hawaii, the base from which he launched his work in household energy. However, his focus shifted when, while traveling in Asia, he observed that the daily task of cooking with available biomass fuels posed a substantial potential risk to human health.

In early, pioneering work, Kirk characterized air pollution from smoky stoves as a major health risk in low-resource countries that depend on biomass for cooking. In the early 1980s, he was the first to measure personal exposures to particulate air pollution in homes with biomass cookstoves. He recognized the implications of the very high kitchen concentrations found in rural households—and the global scale of the problem—particularly for women and young children.

In the ensuing decades, he sparked research, technological innovation, and policy change around biomass fuel burning. He challenged researchers, policy makers, and the private sector to view reliance of low-income populations on solid fuels as not just a failing of public health but a matter of equity and fairness: clean air as a basic human right. When his own research convinced him that improved biomass stoves would not yield necessary health gains, he expressed skepticism about marketing untested “improved stoves.” He redirected his efforts to emphasize the need for expanding access to cleaner fuels, such as liquefied petroleum gas (LPG) and electricity.

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Kirk R. Smith, 1947–2020. Image: Ajay Pillarisetti.

“It is no exaggeration to say that Kirk created the field of household air pollution as we know it today, and many of us might be spending our professional lives in different ways today were it not for his creativity, his drive, his charisma, and his persistence,” said Joshua Rosenthal of the Fogarty International Center, National Institutes of Health.

Although trained in exposure science, Kirk expanded his reach into other disciplines, developing research methods and the tools necessary to fill critical evidentiary gaps. He also led the first-ever air pollution–related randomized controlled trial, conducted in rural Guatemala. The Randomised Exposure Study of Pollution Indoors and Respiratory Effects (RESPIRE) trial evaluated the impact of chimney stoves on child pneumonia and is to date the most cited study in the field of household air pollution. RESPIRE’s rigorous personal exposure assessment and objective measures of child pneumonia laid the groundwork for the multi-country Household Air Pollution Intervention Network (HAPIN) trial on liquefied petroleum gas stoves.

To provide potential alternative justifications for work in household energy, Kirk evaluated the climate impacts of cookstoves. With his students, he created metrics and methods for evaluating the potential health benefits of transitioning to clean cooking in terms of reductions in ambient air pollution and averted disability-adjusted life years and deaths.

His true impact lies in the collaborations he forged and the trainees and colleagues he mentored around the world. At UC Berkeley, Kirk developed the Global Health and Environment master’s program in 2001. He mentored more than 20 master’s students and a dozen doctoral students and postdoctoral fellows. His program through the Fogarty International Center brought Indian scholars for traineeships at UC Berkeley. Kirk often said, “You do not get what you expect, but what you inspect”; this was the mantra by which he evaluated his trainees’ and his own research.

In Guatemala, Kirk’s deep commitment to researchers at the Universidad del Valle de Guatemala and the communities participating in the RESPIRE trial is still felt today. Eduardo Canuz Castro, an air pollution technician who worked on Kirk’s studies since 2001, said, “I was the first Guatemalan to monitor household air pollution. Kirk’s mentorship opened doors for me to this day.”

Kirk’s motivation was not merely to conduct research for academic achievements but to improve rural livelihoods. RESPIRE study results were reported back to the participants in the 23 communities in the study. His daughter, Nadia Diamond-Smith, now an assistant professor at UC San Francisco, spent a summer painting the local health center, and Kirk frequently arrived at the study office bearing chocolate chip cookies made by his wife, Joan Diamond.

Kirk's work in Nepal identified the impact of household air pollution exposure from both biomass and kerosene on lens opacity, cataracts, and tuberculosis among women and on pneumonia in children. His association with research on household air pollution in Nepal dates to 1985 and earlier. Thereafter, he conducted multiple research projects and mentored many Nepalese researchers.

Kirk also has a long history of collaborations in India, where he first monitored household air pollution exposure. He often proudly displayed a picture of Diwali Ben, whom he called the "first person in human history to have her exposure measured doing the oldest task in human history," from his 1981 field work in Gujarat. He visited Diwali Ben some 30 years later to thank her for her participation and shared with her that her photograph, showing her wearing exposure monitoring equipment, had been seen by thousands of people around the world.

Kirk's persistent goal of "cleaning the air" for rural women and children continues to be evident in collaborations with more than 100 colleagues spread across dozens of institutions in India. "He will be remembered not just as the greatest teacher for the household air pollution community of researchers but also as the warmest 'indophile' for the extraordinary friendships he developed in India," said long-term colleague Nirmal Kumar Ganguli, formerly of the Indian Council of Medical Research.

This long history of work in India and deep, bidirectional collaboration with Indian scientists enabled Kirk to serve on numerous Government of India task forces, a role that eventually led to the launch of one of the most ambitious clean fuel programs, Pradhan Mantri Ujjwala Yojana, which has now provided nearly 80 million households in India with access to LPG. "The pages of history may not mention Professor Smith for this great feat," said T.K. Joshi of the Indian Central Pollution Control Board, "but he was the seed out of which this tree has grown."

Kirk was an active collaborator in China as well, inspired in part by a 1983 trip in which he walked for hours to visit rural villages, carrying a carbon monoxide monitor and logging emissions from biomass cookstoves. These were perhaps the first-ever personal exposure measurements in China. In the decades after that trip, he added a strong voice to support the Chinese government's "Million Cookstoves Project" with the goal of conserving fuel by delivering more energy-efficient stoves to millions of households.

During the 1990s, when this kind of government-supported project started to fade away rapidly, Kirk inspired and energized the Chinese scientific community to study household air pollution. His tireless efforts, including several trips to China every year, fueled by his unparalleled power of speech and personal charisma, resulted in a sizable research community in China now addressing policy and sociobehavioral challenges in addition to technology innovations toward health risk reduction.

Kirk's impact in household air pollution research and more broadly in environmental health spanned well beyond research, with lasting impacts in the policy realm. He transformed the approach of the World Health Organization's Air Quality Guidelines. As the 2005 revisions were being made to these guidelines, he noted how poorly they fit the needs of many low- and middle-income countries and offered the concept of interim targets so that these countries would have achievable goals.

Although perhaps best known for his work on household air pollution, Kirk's expertise and vision touched many areas over his career. He served on numerous national and international committees, bringing a new vision of exposure sciences as Chair of the Committee on Human and Environmental Exposure Science in the 21st Century for the National Academy of Sciences. He had an influential voice at the World Health Organization and contributed to the powerful estimates on air pollution made by the Global Burden of Disease project.

Aaron Cohen, principal scientist at the Health Effects Institute and affiliate professor at the Institute of Health Metrics and Evaluation, said, "Kirk believed that only a rigorous and objective comparative global risk assessment among all major risk factors would provide the compelling evidence of air pollution's relative importance needed to support action to reduce burden in those populations who suffer the greatest harm."

In these roles, Kirk's perspectives were unique, often spoken for the voiceless, and always grounded in the latest evidence. His ability to rapidly pivot his perspective in the face of new evidence could be challenging for others to quickly digest, but it was always firmly data-driven and, ultimately, well accepted and inspirational.

Colleagues, and Kirk himself, used to joke that he did his career in reverse, starting with complex, big-picture thinking and moving to field work later in life, a task that in his words was perhaps better suited for 20-year-olds. However, in recent years, he did something that few academics are brave enough or able to do: He shifted his determination to translating the strong body of scientific evidence he had built into policy with a focus on India. This required learning new ways of communicating and thinking—and also spending almost half of each year living in India—with the goal of bringing positive change to millions.

Kirk's legacy lives on through the numerous collaborations and trainees that he cultivated throughout the world. His impact can be counted in the billions of people around the globe who have benefited from his pioneering vision and passion, and in the thousands of scientists, policy makers, and advocates influenced by him to "follow the risk" to ensure people are "healthy so that they can become wealthy." His creativity, his brilliant wit, and his fearless leadership are unparalleled, and he is fondly remembered by his colleagues in Hawaii, Guatemala, India, Nepal, China, the United States, and around the world. Aloha, Kirk.